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UNHOLTZ-DICKIE CORPORATION

vibration generation systems and measurement instruments

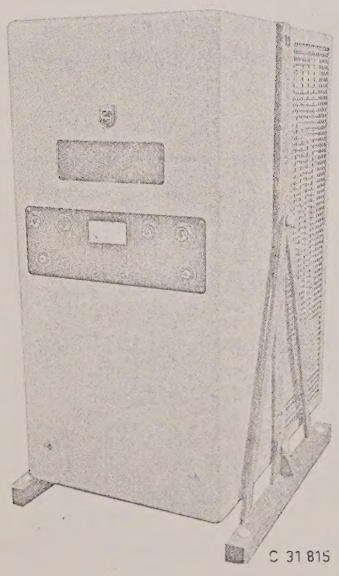
OPERATING MANUAL-MODEL A103

MP MASTER
MA34556

PHILIPS *Service*

ELA
AMPLIFIERS

EL 6472



C 31 815

EL6472/00=2kVA amplifier

Code letter A behind the serial number

As from the serial number 661, the relay RE2 has been added with the connecting posibility for a protecting unit EL6870 (see fig. 1B) and the supply transformers T1 and T2 are provided moreover with taps for 200, 220, 230 and 240 V.

W A R N I N G

The following voltages are present in this amplifier:

+ 4750 V : Anode voltage of the final stage.
+ 700 V : Supply voltage for the various preamplifier stages.
When the amplifier has been switched off one should wait 1 minute before removing the covers or starting work on the amplifier.
In this time the high voltage capacitor C11 has discharged over R13 and R14.

THEREFORE BE CAREFUL !!

As a result of transporting tubes DCG4/1000G-01, drops of mercury can come on the anodes. When the high voltage is switched on, a flashover can therefore occur.
The high voltage may not be switched on until after the heaters of B9 to B14 inclusive have been burning for 30 minutes.

For internal transport, the tubes QB5/1750 (B7 and B8) should be removed. For transport over greater distances these tubes should be carefully packed.

EL6472/50.

A. GENERAL

Fuses.

V11 to V13 incl.	(10A; slow)	: 08 101 79 automatic	: 08 559 46/10
V14	(6A; slow)	: 08 101 78 automatic	: 08 559 46/6
V15	(400 mA)	: A9 999 74/400	
V16	(250 mA)	: A9 999 74/250	

Tubes.

B1 and B2	: E80F	B9 to B14 incl.	: DCG4/1000G-01
B3 to B6 incl.	: EL34	B15 and B16	: DCG1/250
B7 and B8	: QB5/1750	B17	: 4152/01

Dimensions

Height : with base 1010 mm (39 3/4")
without base 933 mm (36 3/4")
Width : without handles 524 mm (20 5/8")
Depth : 670 mm (26 3/8")

Weight : 245 kg.

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For the tube positions, connections and meter positions see the textplate on the inside of the front cover. A textplate for the connections on strip P1 is on the inside of the rear cover.

B. DIAGRAMS.

Fig. 1A : Circuit diagram till serial number 661
Fig. 1B : Circuit diagram as from serial number 661
Fig. 2 : Front view
Fig. 3 : Back view
Fig. 4 : Top view
Fig. 5 : Unit A, B, C, D, E.
Fig. 6 : Circuit diagram ventilator
Fig. 7 to 10 inclusive : Transformers
Fig. 11 : Selenium rectifier
Fig. 12 : Measuring diagram
Fig. 13 : High voltage measurement
Fig. 14 : Feedback measurement

C. ELECTRICAL DATA.

- Mains voltage - - - - - - Till serial number 661
  Switchable 127/220V or 220/380V alternating current with neutral lead.
  Above serial number 661
  Switchable 115/200V, 127/220V, 132/230V and 138/240V or 200/346V, 220/380V, 230/400V or 240/415 V alternating current with neutral lead.
- Mains frequency - - - - 40 - 100 c/s
- Consumption - - - - - - Unloaded and without signal 1.15 kW, power factor = 0.84. Fully loaded : 4kW, power factor = 0.91.
- Minimum permissible power factor of load - - For inductive loading: 0.7 For capacitive loading: 0.85
- Output voltages - - - - - 100-110-127 V; 200-220-254 V.

- Hum and noise - - - - - - -70 dB.
- Distorsion - - - - - - - - < 5 %
- Input impedance - - - - - 10.000 ohms.
- Input sensitivity - - - - about 7.5 V.
- Permissible ambient temperature - - - - - - - 10-40°C.

D. CIRCUIT DESCRIPTION.

1. Input.

The input terminals 1 and 2 are not connected to earth.
When using an asymmetrical voltage source (one side earthed) terminal 2 may be connected to terminal 3 (earth).
The input is short circuited as long as relay RE1 is not energized (during warming up).
The middle of the input transformer secondary winding is connected to earth. Because of this the signals on the grids of B1 and B2 are opposite in phase. The whole amplifier is further connected in balance.

2. Voltage amplifier stages.

These consist of the pentodes B1 - B2 and B3 - B4.
A large feedback voltage is fed to the cathodes of B1 and B2 originating from:

a. The primary winding S1 of the output transformer T4. This feedback voltage is attenuated by R13 and R14.
b. The secondary winding S3 of the output transformer T4. This is a frequency dependent feedback. The voltage is attenuated by R11-C3 and R12-C4 respectively.
With increasing frequencies the impedance of C3 and C4 decreases.
The higher frequencies are hereby fed back more strongly than the lower frequencies. This is to prevent oscillation.

The second stage is D.C. coupled with the first stage.
Part of the anode voltage of B1 and B2 is present on the control grids of B3 and B4 (over R22 and R23 resp.).
When the amplifier is switched on and B3 and B4 are in place, then B1 and/or B2 must never be removed, for otherwise the control grid voltage of B3 and B4 rises to an inadmissibly high value.
Across the common cathode resistor R24 and the measuring resistor R25 appears such a positive voltage that the control grids are negative with respect to the cathodes.
C5 and C6 respectively form a short circuit for alternating current so that the signals amplified by B1 and B2 respectively are not attenuated by R20 and R21 respectively.

3. Driver stage.

This stage is connected to the previous stage via C7 and C8 respectively and the stopper resistors R34 and R33 respectively. It consists of a balanced circuit of two cathode followers B5 and B6.

4. Output stage.

This consists of two tetrodes, type QB5/1750, connected in class B.

The directly heated filaments are fed by windings S4 and S5 of T2. The centre taps of these windings are connected to earth via small measuring resistors. The negative grid voltage for the output tubes is obtained from the cathode voltages of the tubes in the driver stage, and fixed at the correct value by means of R1 and R2.
The output transformer T2 is provided with two 127 V windings, each with taps for 100 and 110 V as well as this there is a feedback winding S3.

5. Supply.

- The amplifiers up to serial number 661 are suitable both for a 220/380V and a 127/220V three phase mains.
- The amplifiers above serial number 660 are suitable both for a 200/346V-, 220/380V-, 230/400V- or 240/415V- and for a 115/200V-, 127/220V-, 132/230V- or 138/240V three phase mains.
  At 200/346V, 220/380V, 230/400V or 240/415V star-connection is used.
  At 115/200V, 127/220V, 132/230V or 138/240V one proceeds to delta connection.

For obtaining the various supply voltages, two transformers are used.

a. A three phase transformer T1 for the anode voltage of the output stage. The +4750 V is obtained from a three phase bridge circuit with the tubes B9 to B14 incl.

b. A single phase transformer T2 for:
   - the heater voltages for the tubes,
   - the anode voltage for the driver stage, the screen grid voltages for the output stage and anode and screen grid voltages, for the amplifier stages (B15 and B16),
   - the -240 V supply for the bimetal relay and for obtaining the negative grid voltage for the output tubes (Gr1).

6. Bimetal relay B17.

The bimetal relay, type 4152-01, with a delay time of about 60 seconds, prevents the high voltage on the rectifier tubes, B9 to B14 incl., and the screen grid voltage for the output tubes from being applied, before B9 to B14 incl. have reached a sufficient temperature.
When SK1 is switched on then:
- the ventilator M1 starts turning,
- the -240 V is supplied. This heats the spiral of the bimetal relay. After 60 seconds this relay closes a contact whereby the circuit of RE1 is closed. Two micro-switches SK2 and SK3 are in series with relay RE1, which are closed when the covers are placed on the amplifier.

  Till serial number 661.

  When RE1 is energized the following occurs:

  a. The heating circuit for the bimetal relay is broken by a break-contact (27 and 28), so that B17 returns to the rest-position.

  Note: If SK2 or SK3 is opened or SK1 switched off, the bimetal relay B17 must first warm up again before RE1 can be energized.

b. Relay RE1 remains energized via a take-over contact (41 and 42).

c. Three makes contacts, for the high voltage transformer T1, are closed.

d. A make contact (45 and 46) closes the circuit for the screen grid voltage of the output tubes.

If the meter switch is placed in position 7 then a deviation of the meter indicates that relay Re1 is energized.

e. A break-contact (47 and 48) removes the short circuit on the input.

As from serial number 661

By closing the bimetallic relay also the energizing circuit of RE2 is closed.
If no protecting unit EL6870 has been connected, an interconnection between the connecting points 23 and 25 should be made.
With the energizing of RE1 and RE2 the following occurs:

a. The heating circuit of the bimetallic relay is interrupted via a break contact of RE2 (61 and 62) so that it returns in the rest position again.

NOTE If SK1 is switched off, the bimetallic relay should first warm up again before RE1 and RE2 can be energized.

b. RE1 and RE2 remain energized via the contact (22 and 23) of RE2.

c. Three make contacts for the high tension transformer T1 are closed by RE1.

d. A make contact (41 and 42) of RE1 closes the circuit for the screen grid voltage of the output valves.

e. A break contact (47 and 48) of RE1 removes the short - circuit at the input and a make contact (45 and 46) of RE1 connects the signal source with T3.

7. Meter.

A meter with switch makes it possible to measure the most important voltages and currents.

E. CHECK MEASUREMENTS.

N.B. 1. For measuring the D.C. voltages use a meter with an internal resistance of 20,000 ohms/volt.
- The Philips meter, type P 811 00 is recommended. With this, all supply voltages (A.C. and D.C.) can be checked.
For measuring the high tension, use is made of a tap on resistors R13 or R14.
The meter P 811 00 is connected between the seventh resistor of R13 or R14 and earth.
See fig. 13 and chapter EVI.

N.B. 2. If the amplifier is measured under load, then use the output voltage "100 V".
- The load resistor must be non inductive and have a value of 5 ohms ± 1 %. This should be measured with a 50 c/s A.C. voltage (voltage-current method). Put a switch for at least 20 A between the amplifier and the load, so that during operation, the load can be switched out of circuit.
- The minimum cross sectional area of the connections between the amplifier and the load resistor should be 6 mm^2.

N.B. 3. If an A.F. generator is connected to the input of the amplifiers up to serial number 661 then during the warm-up period the volume control should always be set at zero (as relay RE1 is not energized).

Now proceed to work as follows:

1 - Connect the earth terminal with a reliable earth.
2 - Check the zero position of the meter; meter switch in position o.
3 - Take all tubes and fuses out of the amplifier.
4 - Check the position of the switch strip on the rear of the high voltage transformer T1.
5 - Connect the output transformer for 100 V.
6 - Short circuit the input terminals 1 and 2.
7 - Connect the 3 phase and neutral leads.

If it is desired to check only one or a few of chapters, treat as follows:
Put the tubes and fuses in the amplifier and set the switches according to the table below.
Carry on further as described in the chapter concerned.

Chapter	I	II	III	IV	V	VI	VII	VIII	IX to XIII incl.
V11 to V13 incl.							x	x	x
V14		x	x	x	x	x	x	x	x
V15					x	x	x	x	x
V16			x	x	x	x	x	x	x
B1 to B6 incl.					x	x	x	x	x
B7 and B8								x	x
B9 to B14 incl.					x	x	x	x	x
B15 and B16					x	x	x	x	x
B17					x	x	x	x	x
SK1			x						x
SK2						x	x	x	x
SK3						x	x	x	x
R load									x
Interconnect 23 and 25						x	x	x	x

I. Check ventilator.

1. In place of V14 connect an A.C. ammeter (1 amp. min.).
2. Switch on SK1 (position 1). The fan starts turning and blows the air upwards.
   The capacitor C16 is connected between the grey wire "a" and the red wire "g" of the three wire motor cable.
   See fig. 7.
   The mains voltage (220V; 50 c/s) is connected to the black wire "e" and the grey wire "a". If the mains voltage is connected to the black wire "e" and the red wire "g" then the direction of rotation of the motor is reversed.
3. The current required should be about 0.6 amp.
   This is the no-load current of transformer T4 plus the ventilator. If this is not the case, check the motor as follows:
   a. Remove capacitor C16.
   b. Measure the resistance of each of the coil pairs : 194 ohms.
   c. Connect a voltage of 220 V 50 c/s between the black and the grey wire of the motor cable. The current drawn should be between 325 and 340 mA.
   d. Reconnect the capacitor between the red and the grey wire. The currents in the capacitor branch and in the other branch should be between 175 and 185 mA. (These values apply for a motor with the fan blades mounted).
4. Switch off SK1 and put in V14.

II. Check Selenium rectifier Gr1.

1. Put the meter switch in position 6.
2. Put in V16.
3. Connect a meter to the A.C. terminals of Gr1.
4. Switch on SK1. The meter should indicate about 180 V.
   On the D.C. terminals of Gr1, -240 V should be measured.
   At the same time, the built-in meter indicates 240 V.
5. Switch off SK1.

III. Check heater voltages.

On the tube sockets measure the following voltages:

1. B9 to B14 incl. : 2.8 V~
2. B1 to B6 incl. : 6.6 V~
3. B7 and B8 : 10.3 V~
4. B15 and B16 : 4.7 V~

IV. Check + 700 V Power Supply and bimetal relay B17.

1. Switch on SK1. On the anode connections of B15 and B16 should be measured 800 V~ with respect to earth.
2. Switch off SK1 and put all the tubes in their places except B7 and B8.

3. Put in V15.
4. Set the meter switch in position 7.
5. Close the safety contacts SK2 and SK3 by placing clamps on them. Interconnect the points 23 and 25 above serial number 660.
   Switch on SK1. After about 60 seconds, relay Re1 is energized and gives the built in meter an indication of about + 700 V.
   Across C12, C14, C15 is measured +685V, +600V, +230V respectively.
6. Open safety contact SK2: RE1 should open.
   Put the meter switch in position 6. The built in meter indicates +210V. Close SK2: the meter indication drops to +170V. Wait till RE1 is energized; the meter indication now is approx. 200V.
   Open safety contact SK3: relay RE1 should drop out then. Close SK3. Interrupt interconnection between 23 and 25: RE1 should release.
7. Switch off SK1.

V. Check amplifier stages and driver stage.

1. Open safety contacts SK2 and SK3 and connection 23-25.
2. Turn R1 and R2 fully clockwise.
3. Connect meter P 811 00 between g1 of B7 and earth.
4. Put the meter switch in position 4 and switch on SK1.
5. Turn R1 slowly anticlockwise, during this process the meter reading should increase from about -60V to about -100V, while the reading on the built in meter should decrease.
6. Set R1 so that the built in meter indicates 18 mA.
7. The same applied for g1 of B8, using R2 and with the meter switch in position 5.
8. Check the D.C. voltages on the basis of this table:

Tube	Measurement Va	Vg1	Vg2	Vk
B1, B2	+175V	- -	+ 85V	2,5V
B3, B4	+375V	+ 53V	+380V	+85V
B5, B6	+700V	-110V	+350V	-80V

All voltages are measured with respect to earth.

Tolerance ± 20 %.

9. Check the meter indications according to the table below.

Meter position	Measurement	Scale	Voltage Current
1	Ik B1	I x 0.1	3.7 mA
2	Ik B2	I x 0.1	3.7 mA
3	Ik B3+B4	I	50 mA
4	Ik B5	II x 0.1	18 mA
5	Ik B6	II x 0.1	18 mA
6	Vb -200V	II	190 V
7	Vg2 B7+B8	I x 10	700 V

10. Connect an A.F. generator (e.g. GM 2308) to the input terminals 1 and 2 and interconnect terminals 2 and 3.
11. Connect a vacuum tube voltmeter (e.g. GM 6004) via a 470,000 pF capacitor (code number A9 999 06/470K) to the control grid of B7 or B8.
12. Close the safety contacts SK2 and SK3, and interconnect the points 23 and 25, wait until relay Re1 is energized. Set the A.F. generator to 1000 c/s and feed a voltage of 88 mV to the input.
The voltage on the grid of B7 or B8 should be about 25V. If this voltage is not measured, then, with the vacuum tube voltmeter, measure in turn the voltages on points B, C, D, E and F and thus localise the fault.
A deviation of more than 20 % points to a fault in the relevant stage.

VI. Check high voltage power supply.

1. Remove the cables between the anodes of B7 and B8 and the output transformer T4.
B7 and B8 must be definitely removed.
2. Connect meter P 811 00 across the seventh resistor of R13 or R14. (See fig. 13).
When using vacuum tube voltmeter GM 7635 and measuring probe GM 4579, this is connected parallel to C11.
3. Insert V11 to V13 in the amplifier.
4. Switch on SK1. After relay Re1 is energized the high voltage should be about 4750 V.
This corresponds to a deviation of +710 to +730 V on the 1200 V range of the meter P 811 00.
5. Switch off SK1.

Note: When the amplifier is loaded, the meter indication is +650 to +670 V.

VII. Adjustment of idle current B7 and B8.

1. Put B7 and B8 in the amplifier and connect up the anodes.
2. Put the meter switch in position 8 and switch on SK1.
3. With the aid of R1 adjust the idle current of B7 to 50 mA.
4. Switch the meter switch to position 10. The built in meter now also indicates 50 mA. (different scale!).
5. Put the meter switch in position 9.
6. With the aid of R2 adjust the idle current to 50 mA.
7. Switch the meter switch to position 11. The built in meter now also indicates 50 mA (different scale!).
8. Repeat the points 2, 3, 5 and 6.
9. Switch off SK1.

VIII. Check feedback.

1. Disconnect R11/C3 from R57 and R12/C4 from R58. This is done on the rear of the output transformer T4. Disconnect R13 from R7/R15 and R14 from R8/R16. Connect R13 and R14 to earth and keep measuring the high voltage. See fig. 14.
2. Switch on SK1.
3. Bring the output voltage up to 10V - 1000 c/s with the load switched on.
4. Disconnect the output of the A.F. generator and set the A.F. generator in the position for 10 V output voltage.
5. Switch off SK1 and connect R11/C3 to R57 and R12/C4 to R58.
6. Switch on SK1 and wait until relay Re1 is energized. Connect the A.F. generator again. The output voltage should now have dropped to about 1.85 V.
7. Disconnect the output of the A.F. generator.
8. Switch off SK1 and connect R13 to R7/R15 and R14 to R8/R16.
9. Switch on SK1 and wait until relay Re1 is energized. Connect the A.F. generator again. The output voltage should now have dropped to about 530 mV.

IX. Frequency characteristic.

1. Switch on the load resistor and bring the output voltage up to 25 V - 1000 c/s.
2. Keep the input voltage constant and vary the frequency from 40 - 10,000 c/s.
3. The deviation of the output voltage amounts to:

   a. Between 40 and 3000 c/s : ± 1 dB.
   b. Between 40 and 10000 c/s : ± 2.5 dB.

X. Internal resistance of the output.

Drive the amplifier to give 50 volts. On removing the load, the output voltage should be more than:

frequency	output voltage
40 c/s	55 V
1000 c/s	56 V
2000 c/s	57 V
3000 c/s	60 V

XI. Hum and noise.

1. Short circuit the input terminals 1 and 2.
2. The output voltage should now be less than 33 mV.

XII. Distortion.

With an output voltage of 100 volts, the maximum distortion may reach the values in the table below.

frequency	distortion
60 c/s	2 %
400 c/s	2 %
2000 c/s	2.5 %
3000 c/s	5 %

XIII. Input voltage.

For obtaining an output voltage of 100 V at 400 c/s, the input voltage must be 7.5 V $\pm$ 10 %.

Maintenance of relays.

As during normal operation relay contacts clean themselves, maintenance is hardly required.
Nevertheless, a regular inspection will have to be carried out on the following points:

A. Gathering of dust on the contacts.
B. Burning in of the contacts.

Ad A. Any accessive gathering of dust can be removed by means of a soft hair brush, while the dust is sucked up with a small vacuum cleaner (type battery car vacuum-cleaner).

Ad B. If contacts are burnt in, they can be rounded off and polished with a burnishing tool, Philips code nr. SYA 8549; of course the distance and pressure setting of the contacts should remain the same.
Through material deposit, it may happen that a tang is developed on the positive contact, and a dimple in the negative contact.
A tang can also be removed by means of the tool, SYA 8549; the edges of the dimple should be polished with this tool. If contacts are burnt in too deeply, the relay will have to be replaced.
Only if the inspection is carried out regularly, it will be possible for you to order in time.

EL6472/00

Pos.	Fig.	S	Code number	Description
1	2	xx	967/8	Mounting support (8x)
2	2		B1 507 09	Tube socket
3	2		976/8x12	Connection cap
5	2		974/4x50	Fuse holder
6	2	xx	973/12	Arrow knob
7	2	xx	973/12	Arrow knob
8	2		974/4x50	Fuse holder
9	2	xx	975/7x4	Grommet (2x)
10	2	xx	975/5.5x4	Grommet (2x)
11	2	xx	967/T14	Connection strip
1	3	xx	975/11x6	Grommet (2x)
2	3	xx	975/11x6	Grommet (3x)
3	3	xx	975/5.5x4	Grommet (2x)
1	4		08 145 71.0	Screw cap
2	4		974/P10	Set screw
3	4		B8 703 00.0	Fuse holder (4x)
4	4		976/9x12	Tube socket
5	4		976/V8x17	Tube socket
6	4	xx	967/12	Connection strip
7	4	xx	E3 939 09	Fan blade
9	4	x	B1 885 07	Connection cap (2x)
10	4	xx	967/8	Mounting support (1x)
11	4		B1 505 64	Tube socket (2x)
12	4		976/4x16	Tube socket (3x)
13	4		974/P6	Set screw

[illegible]

[illegible]

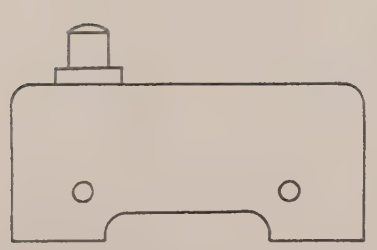
[illegible]

[illegible]

S

EL 6472

T1	x	T1 830 39	Serial number 661			
	x	T1 831 01	Serial number 660			
T2	x	V3 616 97.0	Serial number 661			
	x	V3 616 97.1	Serial number 660			
T3	x	E3 228 75				
T4	x	T1 960 45				
GR1		V3 627 09				
L1	x	V3 598 50.0	3,2 H (27 Ω)			
L2	x	V3 598 49.0	11 H			
SK1		08 545 05				
x		08 523 59				
SK2		V3 577 73.0				
x		08 523 59				
SK3		V3 577 73.0				
SK4		0D 303 02/12DVK				
C1		906/220K	220.000 pF	10 %	350 V	paper
C2		906/220K	220.000 pF	10 %	350 V	paper
C3		905/1K5	1.500 pF	10 %		mica
C4		905/1K5	1.500 pF	10 %		mica
C5		906/22K	22.000 pF	10 %	350 V	paper
C6		906/22K	22.000 pF	10 %	350 V	paper
C7		906/V220K	220.000 pF	10 %	1000 V	paper
C8		906/V220K	220.000 pF	10 %	1000 V	paper
C9		906/V560K	560.000 pF	10 %	700 V	paper
C10		906/V560K	560.000 pF	10 %	700 V	paper
C11	x	48 015 10/X2M	2 µF	10 %	5500 V	paper
C12		48 115 10/V6M	6 µF	10 %	1000 V	paper
C13		908/E10M	10 µF	10 %	500 V	paper
C14		48 115 10/V6M	6 µF	10 %	1000 V	paper
C15		48 115 10/V6M	6 µF	10 %	1000 V	paper
C16		49 179 76.0	1,8 µF			
C17		906/V100K	100.000 pF	10 %	1000 V	paper
C18		906/V100K	100.000 pF	10 %	1000 V	paper



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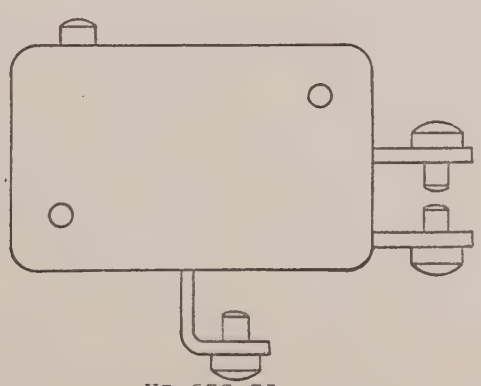


V3 577 73

R1	B8 316 00B/GE50K		50 kΩ	lin.				carbon
R2	B8 316 00B/GE50K		50 kΩ	lin.				carbon
R3	901/27E		27 Ω		1%	0.125	W	carbon
R4	901/27E		27 Ω		1%	0.125	W	carbon
R5	901/390E		390 Ω		1%	0.5	W	carbon
R6	901/390E		390 Ω		1%	0.5	W	carbon
R7	901/180E		180 Ω		1%	0.5	W	carbon
R8	901/180E		180 Ω		1%	0.5	W	carbon
R9	902/1M		1 MΩ		10%	0.5	W	carbon
R10	902/1M		1 MΩ		10%	0.5	W	carbon
R11	2x 901/1K5) par. 2x 901/1K5)		1500 Ω		2%	2	W	carbon
R12	2x 901/1K5) par. 2x 901/1K5)		1500 Ω		2%	2	W	carbon
※※ R13	48 768 05/100K	7x	100 kΩ	ser.	5%	13.6	W	wire
※※ R14	48 768 05/100K	7x	100 kΩ	ser.	5%	13.6	W	wire
R15	901/W11E		11 Ω		1%	0.4	W	wire
R16	901/W11E		11 Ω		1%	0.4	W	wire
R17	900/120K		120 kΩ		10%	1	W	carbon
R18	900/18K		18 kΩ		5%	1	W	carbon
R19	900/18K		18 kΩ		5%	1	W	carbon
R20	901/470K		470 kΩ		5%	0.5	W	carbon
R21	901/470K		470 kΩ		5%	0.5	W	carbon
R22	901/270K		270 kΩ		5%	0.5	W	carbon
R23	901/270K		270 kΩ		5%	0.5	W	carbon
R24	938/B1K8		1800 Ω		10%	8.5	W	wire
R25	901/W1E		1 Ω		1%	0.4	W	wire
R26	938/B39K		39 kΩ		10%	8.5	W	wire
R27	938/B12K		12 kΩ		5%	8.5	W	wire
R28	938/B12K		12 kΩ		5%	8.5	W	wire
R29	902/470K		470 kΩ		10%	0.5	W	carbon
R30	902/470K		470 kΩ		10%	0.5	W	carbon
R31	900/56K		56 kΩ		10%	1	W	carbon
R32	900/33K		33 kΩ		10%	1	W	carbon
R33	902/1K		1 kΩ		10%	0.5	W	carbon
R34	902/1K		1 kΩ		10%	0.5	W	carbon
R35	938/B6K8		6800 Ω		10%	8.5	W	wire
R36	938/B6K8		6800 Ω		10%	8.5	W	wire
R37	901/W6E8	2x	6,8Ω	par.	1%	0.4	W	wire
R38	901/W6E8	2x	6,8Ω	par.	1%	0.4	W	wire
R39	938/B33K		33 kΩ		10%	6.8	W	wire
R40	938/B33K		33 kΩ		10%	6.8	W	wire
R41	938/B33E		33 Ω		10%	4.7	W	wire
R42	938/B33E		33 Ω		10%	4.7	W	wire
R43	2x 901/820K) par. 2x 901/820K)		820 kΩ		2%	1	W	carbon
R44	901/470E		470 Ω		1%	0.5	W	carbon
R45	901/W1E6	2x	1,6Ω	par.	1%	0.4	W	wire
R46	901/W1E6	2x	1,6Ω	par.	1%	0.4	W	wire

R47	901/W1E	5 x 1	Ω par.	1%	0.4	W	wire
R48	901/W1E	5 x 1	Ω par.	1%	0.4	W	wire
R49	2x 901/300K	150	kΩ	2%	1	W	carbon
R50	901/W100F	100	Ω	1%	0.4	W	carbon
R51	931/F1K5	1500	Ω	5%	13.6	W	wire
R52	938/B1K5	1500	Ω	10%	8.5	W	wire
R53	938/B33K	33	kΩ	10%	8.5	W	wire
R54	2x 901/100K) 2x 901/100K) par.	100	kΩ	10%	2	W	carbon
R55	938/B27K	27	kΩ	10%	8.5	W	wire
R56	938/B27K	27	kΩ	10%	8.5	W	wire
R57	938/B820E	820	Ω	5%	6.8	W	wire
R58	938/B820E	820	Ω	5%	6.8	W	wire
R59	938/B10K	10	kΩ	5%	8.5	W	wire

RE1	ND 306 21.0
RE2	NF 164 48
V1	P 812 67.0
M1	JW 303 00.6

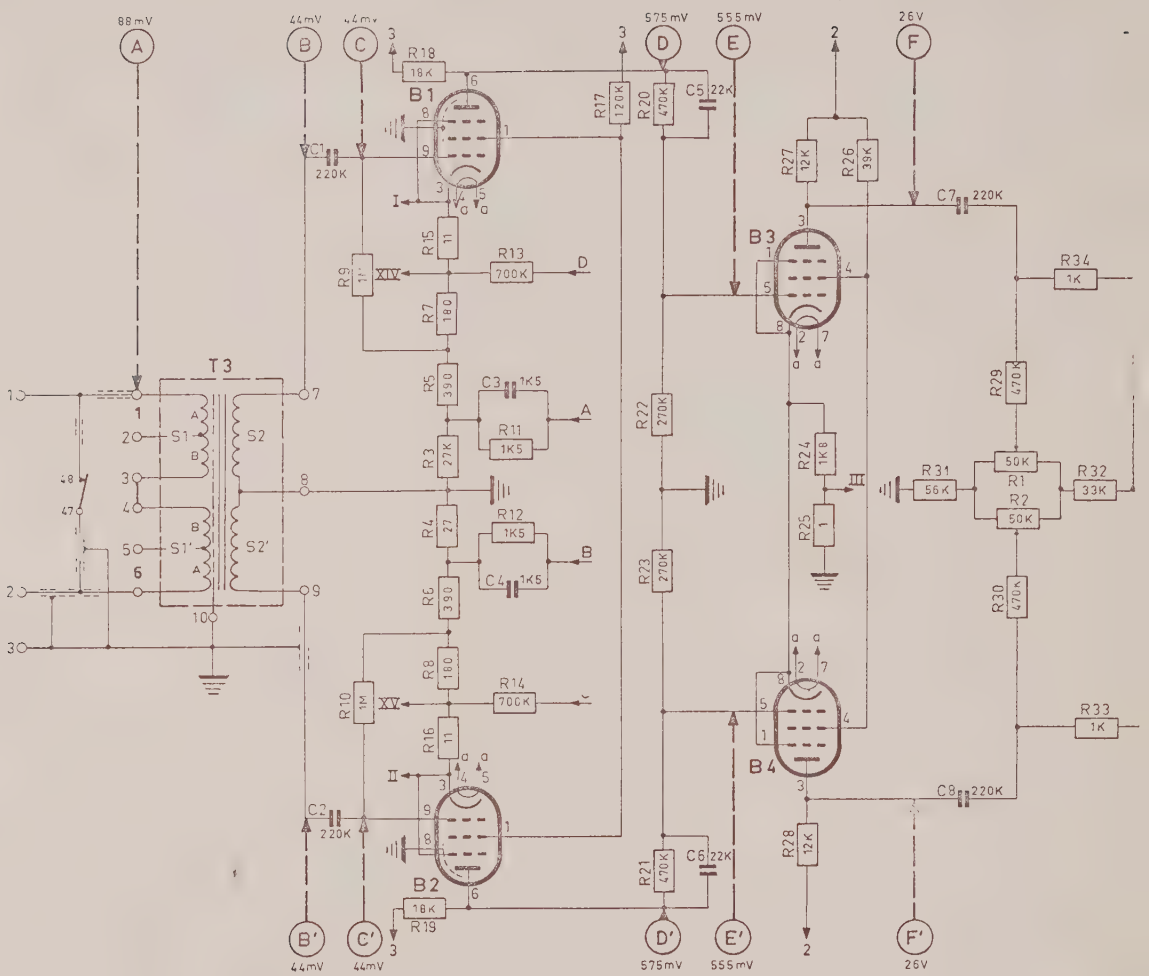
xx The value of R13 and R14 mutually may differ 1 % maximum.

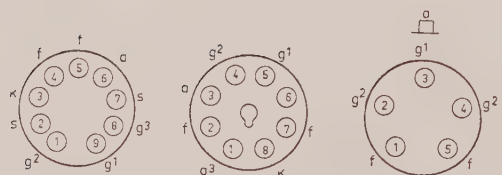
xx Les valeurs de R13 et R14 peuvent différer 1 % au maximum entre elles.

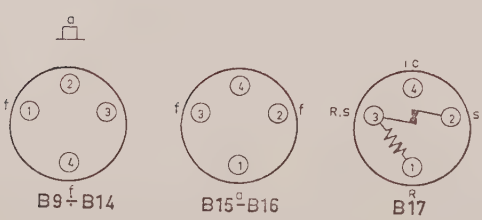
xx Die Werte von R13 und R14 dürfen untereinander 1 % maximal verschieden sein.

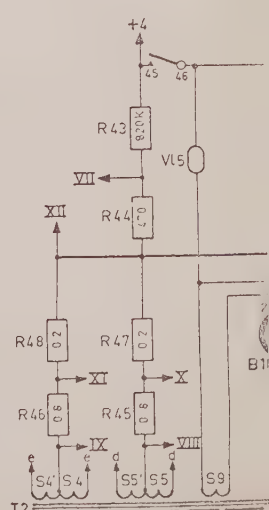
xx R13 en R14 mogen onderling maximum 1 % in waarde verschillen.

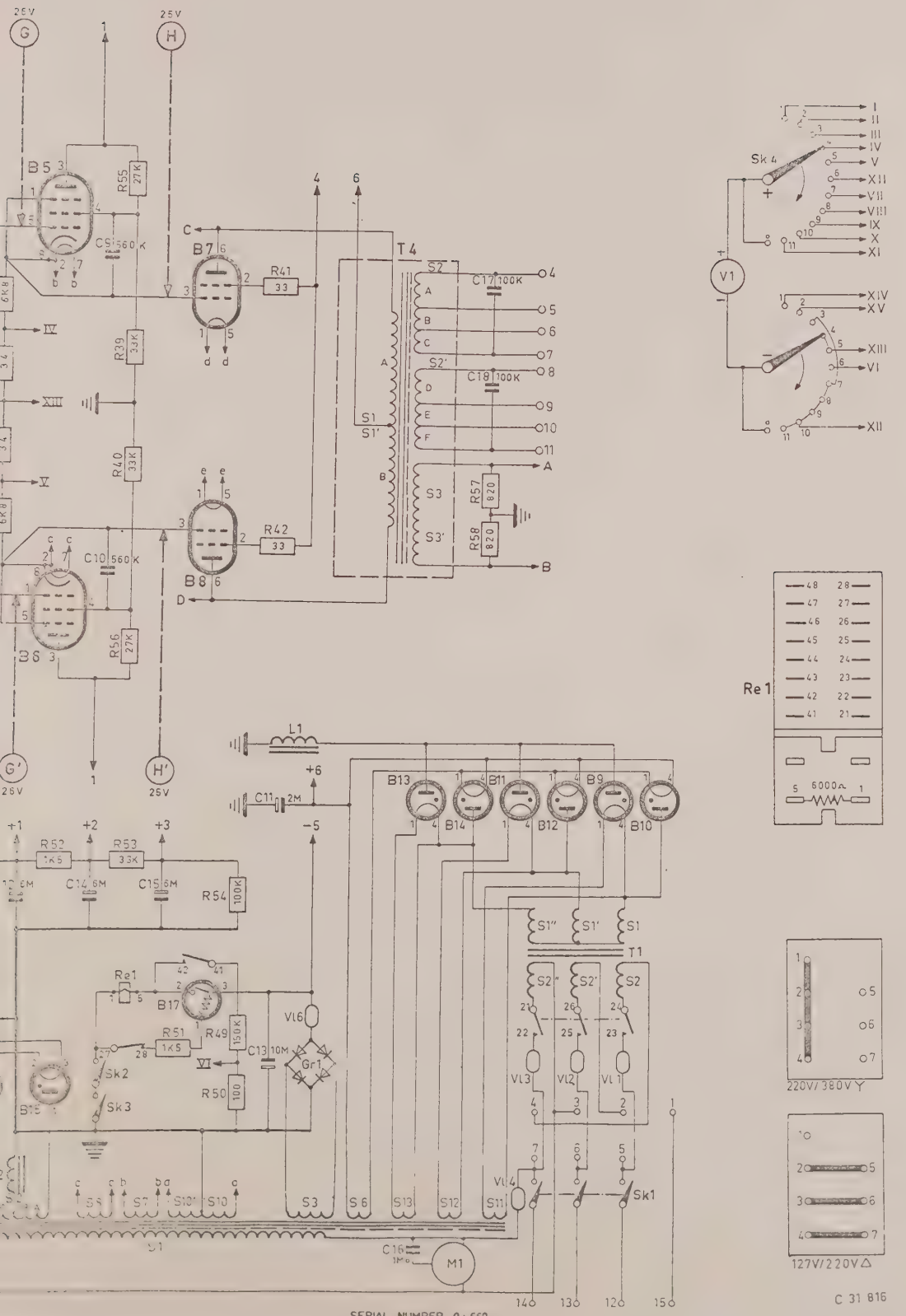
xx Los valores de R13 y R14 pueden difeıir 1 % al máximo entre si.


88mV
44mV
44mV
575mV
555mV
26V
A
B
C
D
E
F
B'
C'
D'
E'
F'
B1
B2
B3
B4
T3
R18 18K
R17 120K
R20 470K
C5 22K
C1 220K
C2 220K
C7 220K
C8 220K
C6 22K
R27 12K
R26 39K
R34 1K
R29 470K
R31 56K
R1 50K
R2 50K
R32 33K
R30 470K
R33 1K
R28 12K
R21 470K
R22 270K
R23 270K
R24 1K8
R25 1
R15 11
R16 11
R13 700K
R14 700K
R9 1M
R10 1M
R7 180
R8 180
R5 390
R6 390
R3 27K
R4 27
C3 1K5
R11 1K5
R12 1K5
C4 1K5
R19 18K
S1
S2
S1'
S2'
I
II
III
XIV
XV


B1–B2
B3÷B6
B7–B8

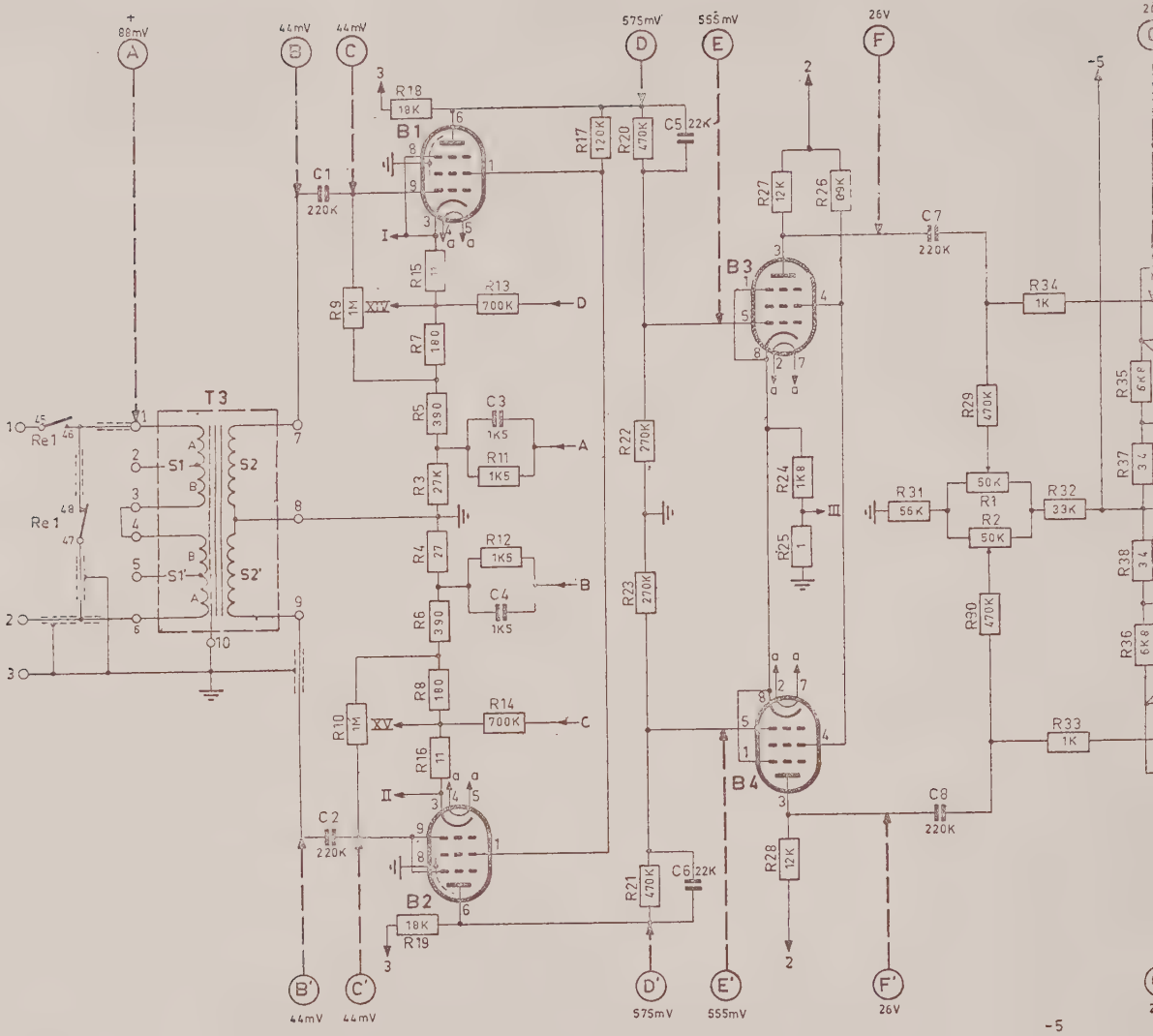

B9÷B14
B15÷B16
B17

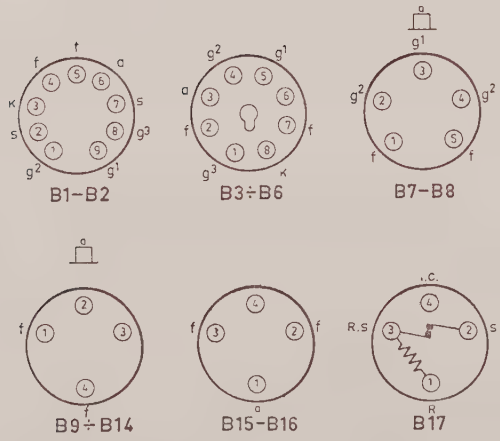

+4
R43 820K
VL5
R44 470
R48 0.2
R47 0.2
R46 0.6
R45 0.6
S4'
S4
S5'
S5
S9
T2

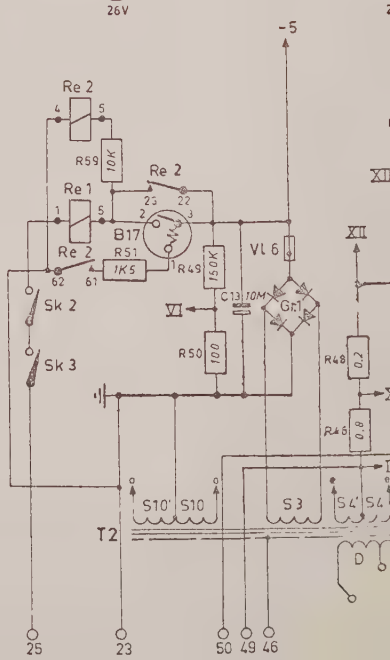


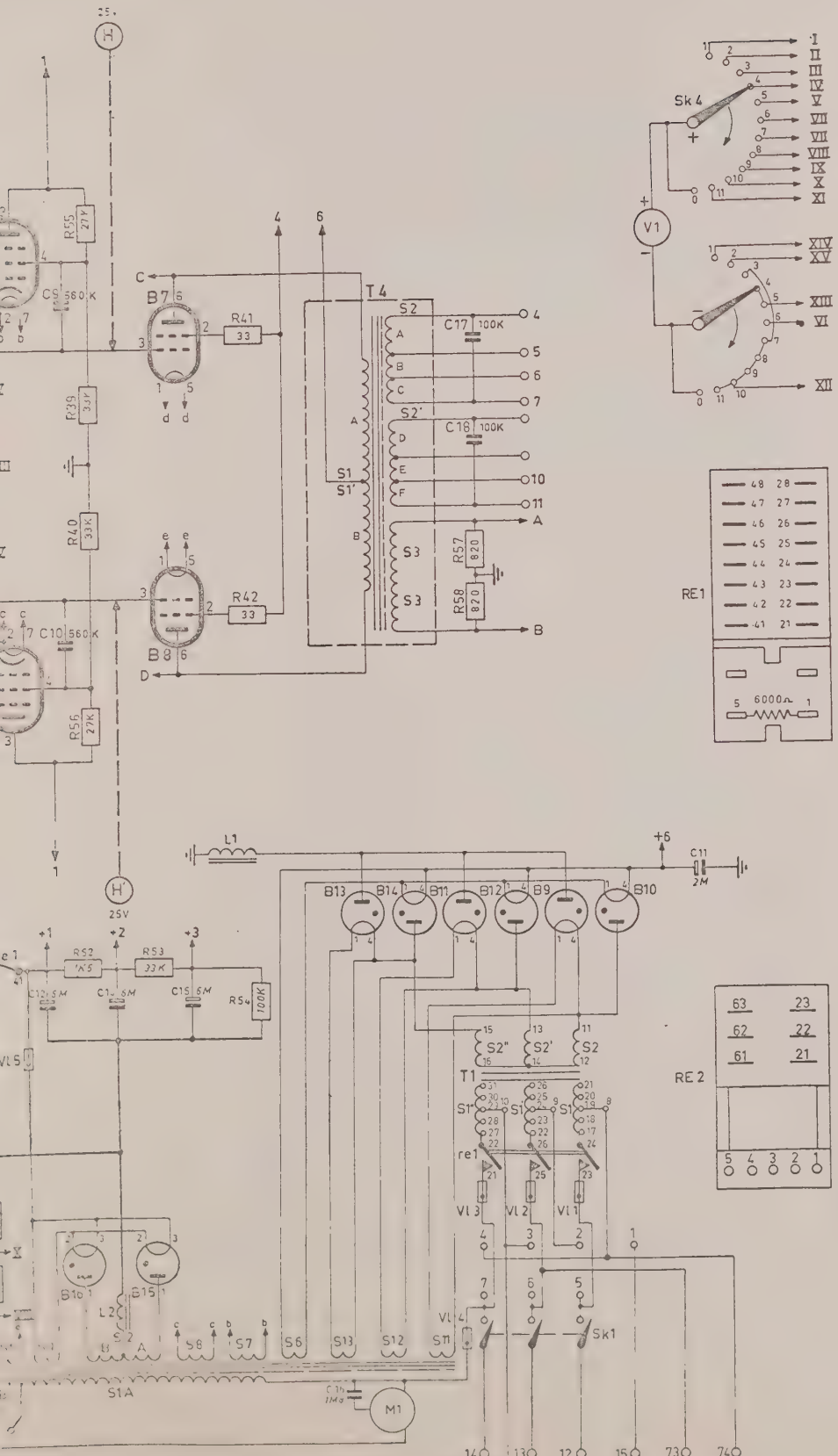
SERIAL NUMBER 0-660

Fig.1A


88mV
44mV
44mV
575mV
555mV
26V
B1
B2
B3
B4
T3
R18 18K
R19 18K
R17 120K
R20 470K
R21 470K
C5 22K
C6 22K
C1 220K
C2 220K
C7 220K
C8 220K
R27 12K
R26 69K
R28 12K
R22 270K
R23 270K
R24 1K8
R25 1
R29 470K
R30 470K
R31 56K
R32 33K
R1 50K
R2 50K
R34 1K
R33 1K
R35 6K8
R36 6K8
R37 3K4
R38 3K4
R9 1M
R10 1M
R7 180
R8 180
R5 390
R6 390
R3 27K
R4 27
R15 11
R16 11
R13 700K
R14 700K
C3 1K5
R11 1K5
R12 1K5
C4 1K5
Re 1
S1
S2
S1'
S2'
B'
C'
D'
E'
F'


B1–B2
B3÷B6
B7–B8
B9÷B14
B15–B16
B17


Re 2
Re 1
R59 10K
B17
R51 1K5
R49 150K
Vl 6
C13 10M
Gr 1
Sk 2
Sk 3
R50 100
R48 0,2
R48 0,8
T2
S10'
S10
S3
S4'
S4
25
23
50
49
46



SERIALNUMBER 660 ÷ ···

C 31 816A

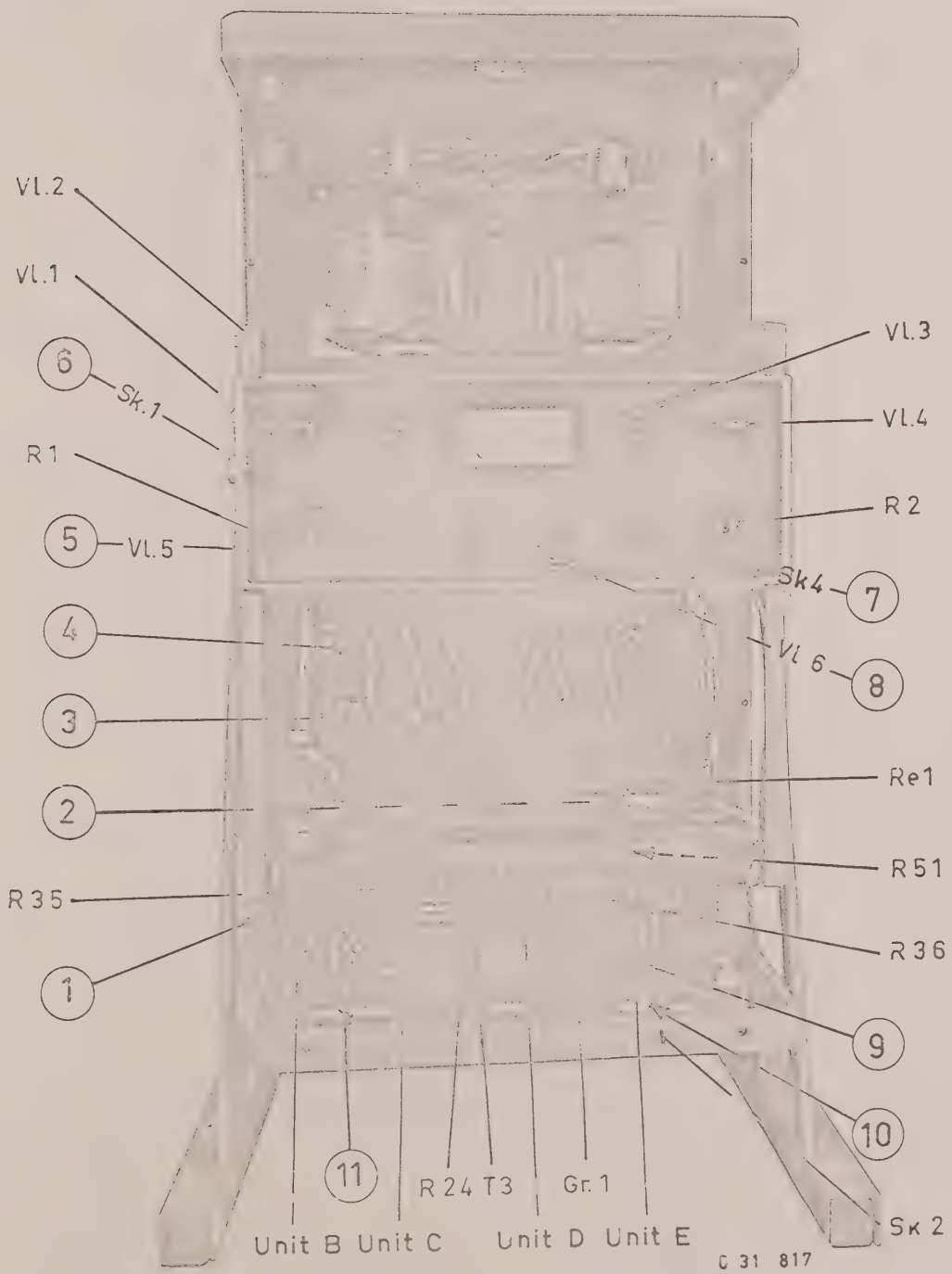

Vl.2
Vl.1
6
Sk.1
R1
5
Vl.5
4
3
2
R35
1
Vl.3
Vl.4
R 2
Sk4
7
Vl 6
8
Re1
R51
R36
9
10
11
R 24
T3
Gr. 1
Sk 2
Unit B
Unit C
Unit D
Unit E
C 31 817

Fig.2.

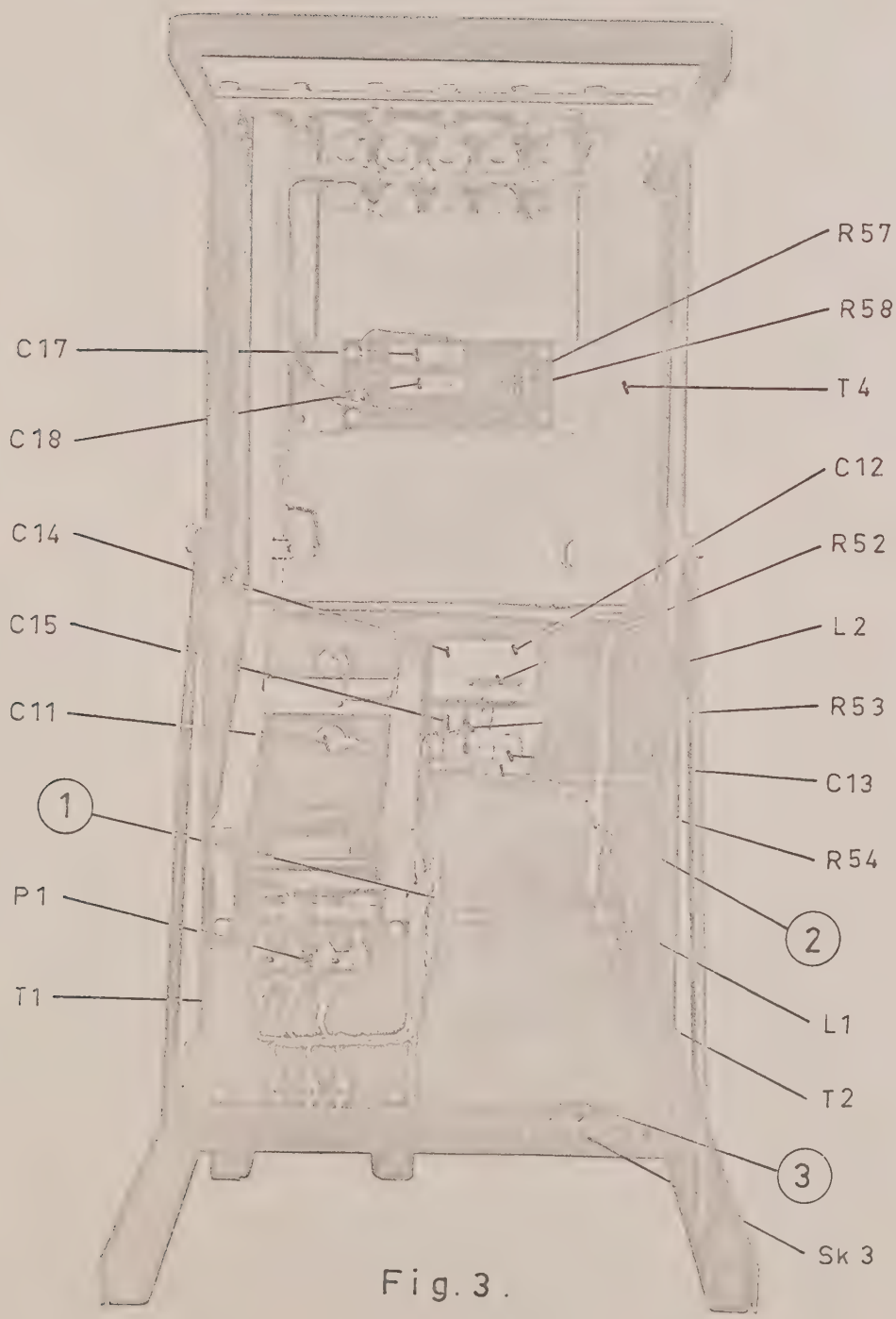

R57
R58
C17
T4
C18
C12
C14
R52
C15
L2
C11
R53
C13
1
R54
P1
2
T1
L1
T2
3
Sk 3

Fig. 3.

C 31 818

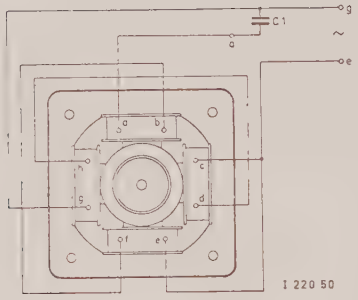
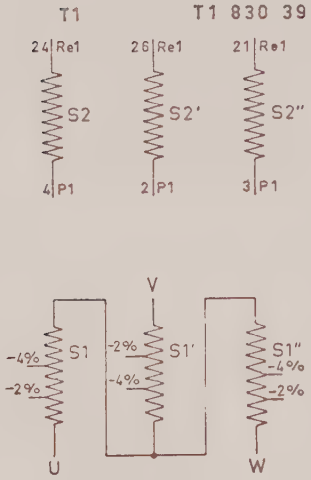
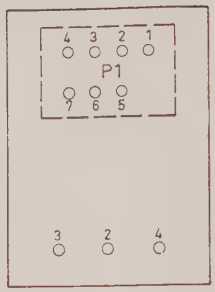


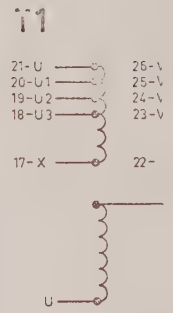
Fig.6





S1-S1'-S1''	S2-S2'-S2''	
2035	220	V
75	<1	Ω

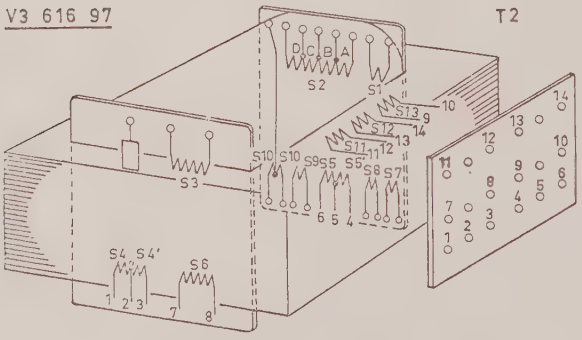
C 31 823



S1-S1'	
190	19
200	20

SERIAL NUMBER 0÷660

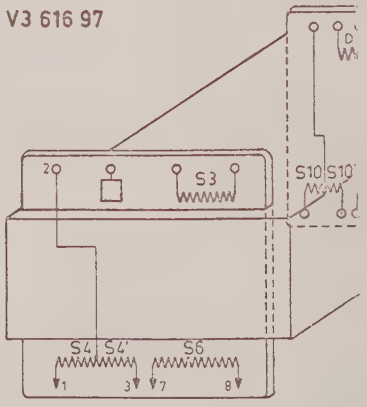
Fig.7A



S1	S2		S3	S4=S4'=S5=S5'	S6=S11=S12=S13	S7=S8	S9	S10=S10	
	A=D	B=C							
220	47	750	180.5	5.17	2.82	6.58	4.7	3.29	V
<1	86		26	<1	<1	<1	<1	<1	Ω

C 31 824

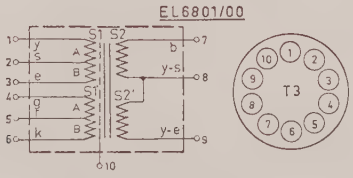
OR
OU
ODER
OF
O



S1	S2		S3	S4=S
	A=D	B=C		S5=S
220	50	600	192	5.5
0.8	86		26	<1

SERIAL NUMBER 0÷660

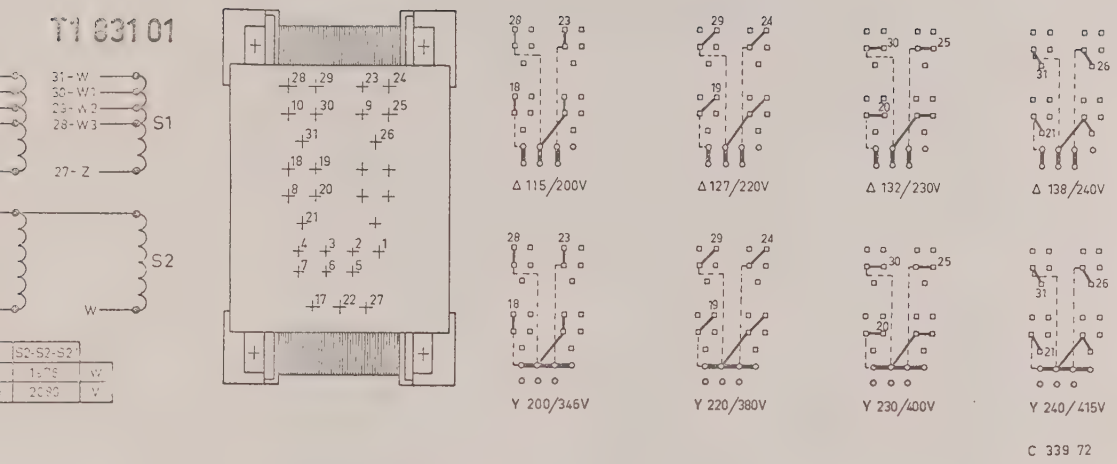
Fig.8A



S1-S1'		S2-S2'	
A	B		
832	1672	2500	W
370	815	900	Ω

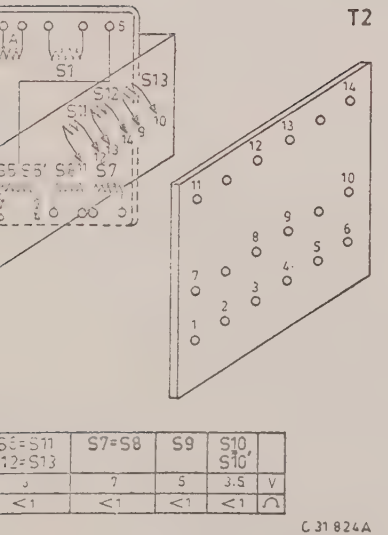
C 31 696

Fig.9



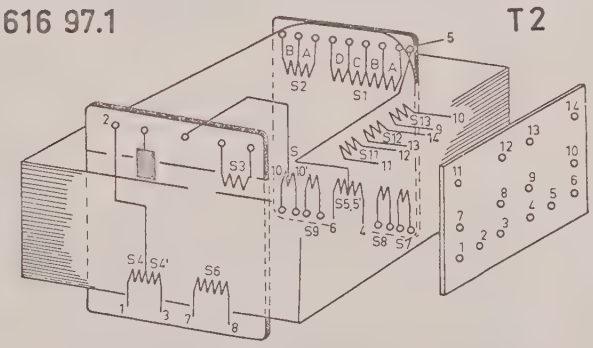
SERIAL NUMBER 660 ÷ ---

Fig.7B



S6=S11 S12=S13	S7=S8	S9	S10 S10'	
3	7	5	3.5	V
<1	<1	<1	<1	Ω

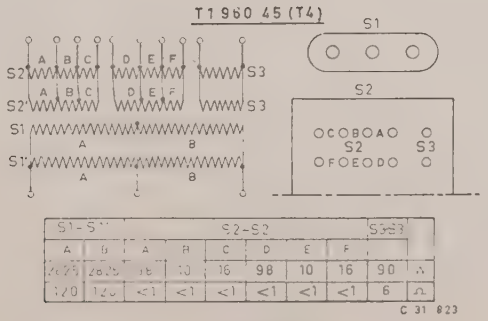
V3 616 97.1



S1				S2	S3	S4+S4' S5+S5'	S6=S11 S12=S13	S7 S8	S9	S10 S10'	
A	B	C	D	A=B							
200	19,7	10,3	10,3	797	180,5	10,34	2,82	6,58	4,7	3,29	V
1,1				86	26	<1	<1	<1	<1	<1	Ω

SERIAL NUMBER 660 + ---

Fig.8B



S1 - S1'		S2 - S2'						S3 - S3'	
A	B	A	B	C	D	E	F		
220	220	98	10	16	98	10	16	90	Ω
120	120	<1	<1	<1	<1	<1	<1	6	Ω

Fig.10

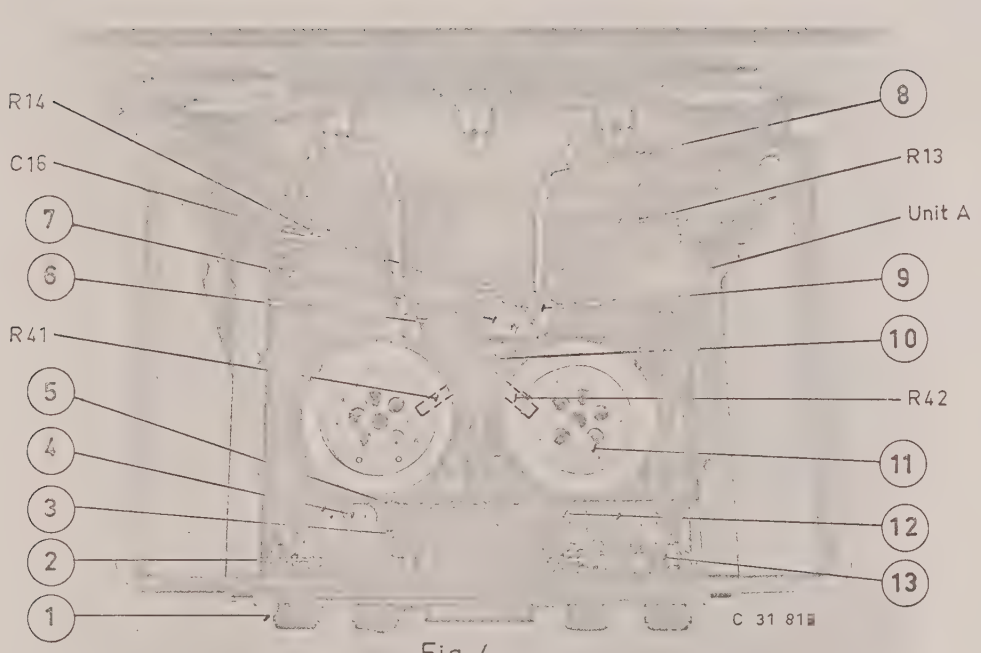

R14
C16
7
6
R41
5
4
3
2
1
8
R13
Unit A
9
10
R42
11
12
13
C 31 81

Fig. 4.

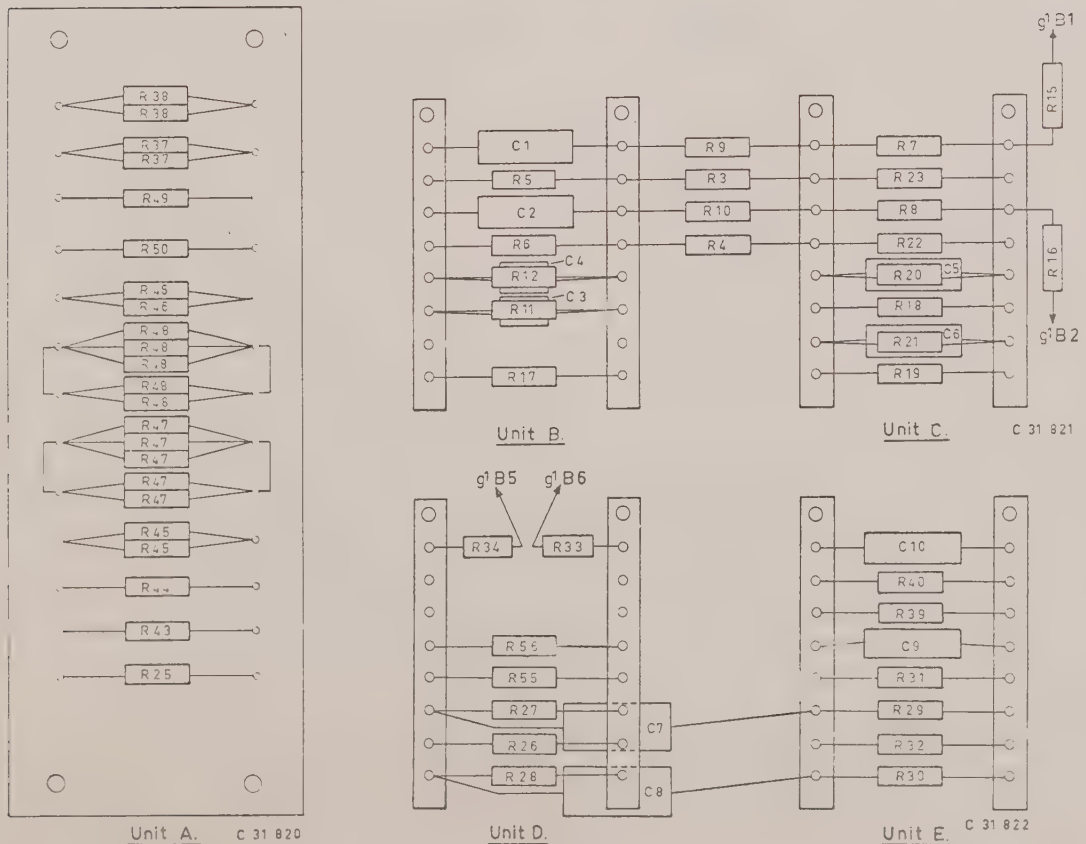

R38
R36
R37
R39
R50
R35
R46
R48
R49
R47
R45
R44
R43
R25
Unit A.
C 31 820
C1
R5
C2
R6
C4
R12
C3
R11
R17
R9
R3
R10
R4
R7
R23
R8
R22
R20
C5
R18
R21
C6
R19
g1B1
R15
R16
g1B2
Unit B.
Unit C.
C 31 821
g1B5
g1B6
R34
R33
R56
R55
R27
R26
R28
C7
C8
C10
R40
R39
C9
R31
R29
R32
R30
Unit D.
Unit E.
C 31 822

Fig.5

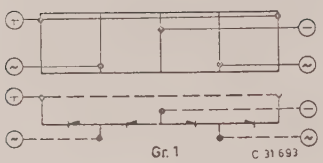


Fig.11

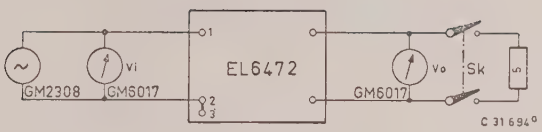


Fig.12

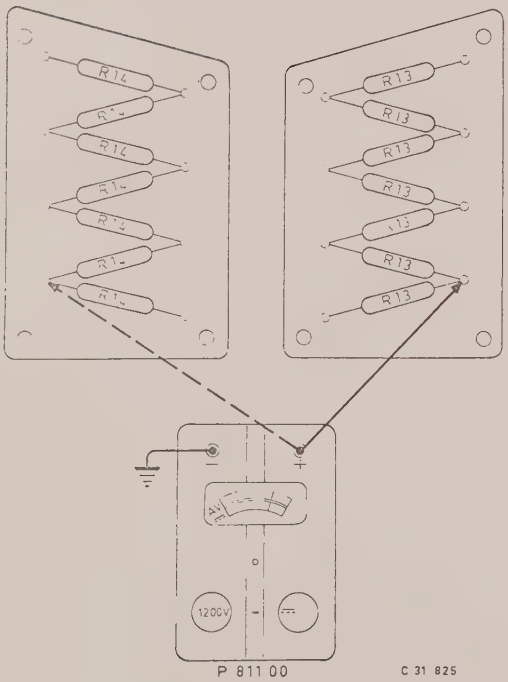


Fig.13

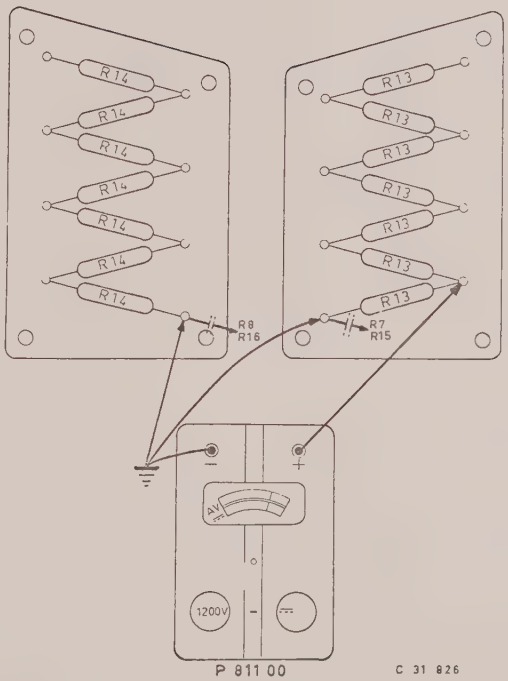


Fig.14

PHILIPS Service

INFORMATION

1-3-1961	EL 6472/00	Eb 141

The 2 KVA amplifier EL 6472/00 has undergone the following modifications :

Electrical parts list

T1	changes to	T1 831 01.1
T2	" "	V3 616 97.2
T3	" "	V3 622 51
GR1	" "	SR 250 B 150

The primary side of the high tension transformer T1 and the filament transformer T2 consists of 5 coils. It is now possible to choose a voltage from the following range 190 - 200 - 210 - 230 - 240 and 250 volt.

The connecting terminals 73 and 74 have been displaced from points 6 and 4 respectively of the switch plate to 39 and 43 respectively of the switch plate. The protection unit which is connected to points 73 and 74 now always obtains a supply voltage of 220 volt.

Figures

Fig. 1 Circuit diagram
Fig. 2 Filament transformer T2
Fig. 3 Input transformer T3
Fig. 4 High tension transformer T1

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D. Willis

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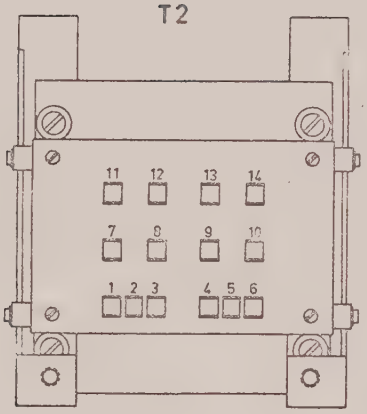
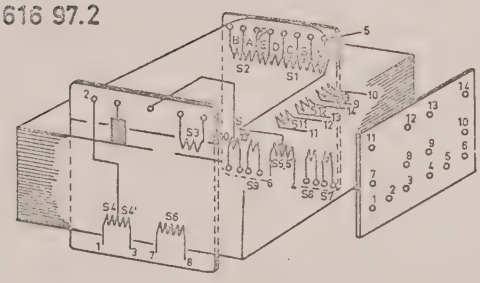
T2



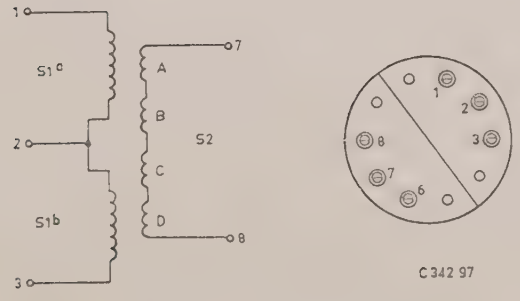
V3 616 97.2



S1					S2	S3	S4+S4'	S6=S11	S7	S9	S10	
A	B	C	D	E	A=B		S5+S5'	S12=S13	S8		S10'	
10,3	19,0	19,7	19,7	10,3	79,7	130,5	10,34	2,82	6,58	4,7	3,29	V
1,1					86	26	<1	<1	<1	<1	<1	Ω

C 339 73A

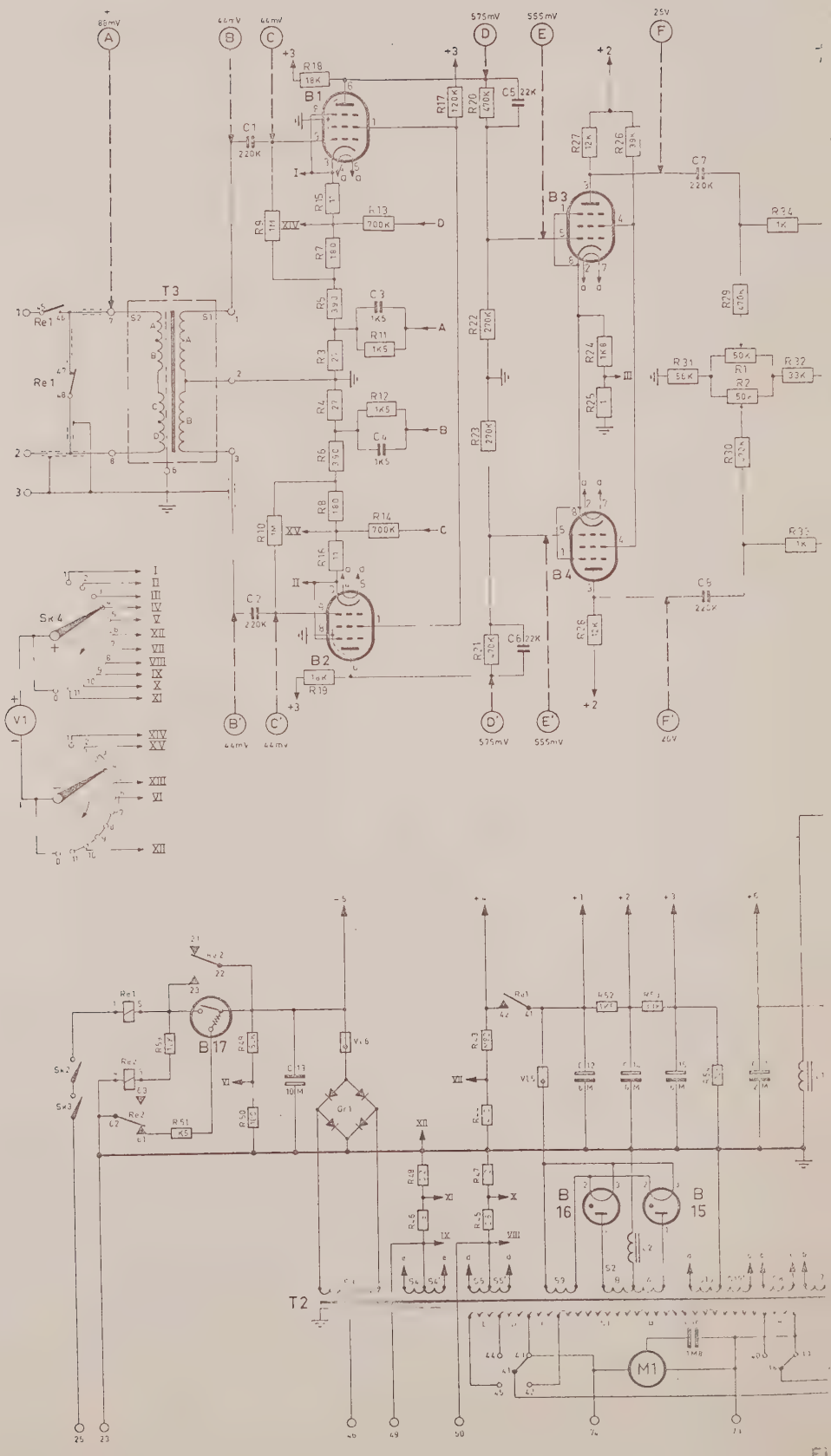
Fig.2

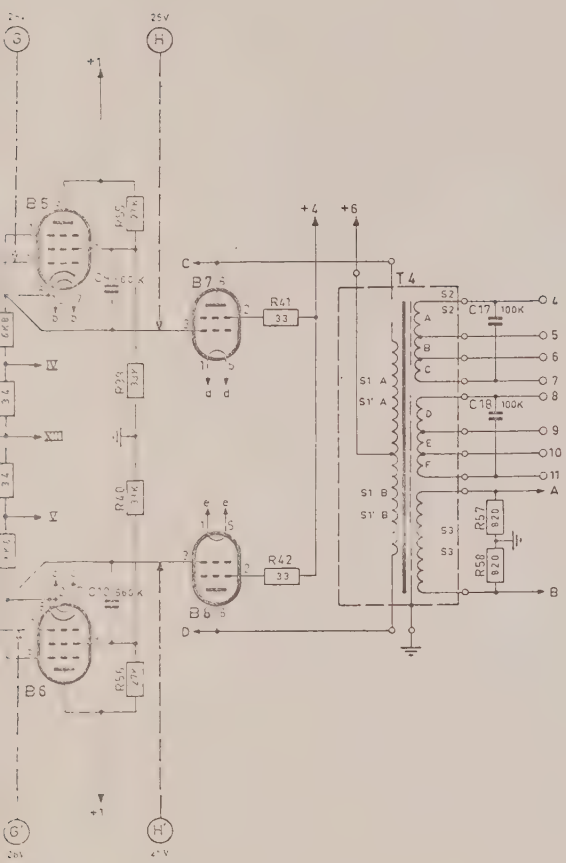


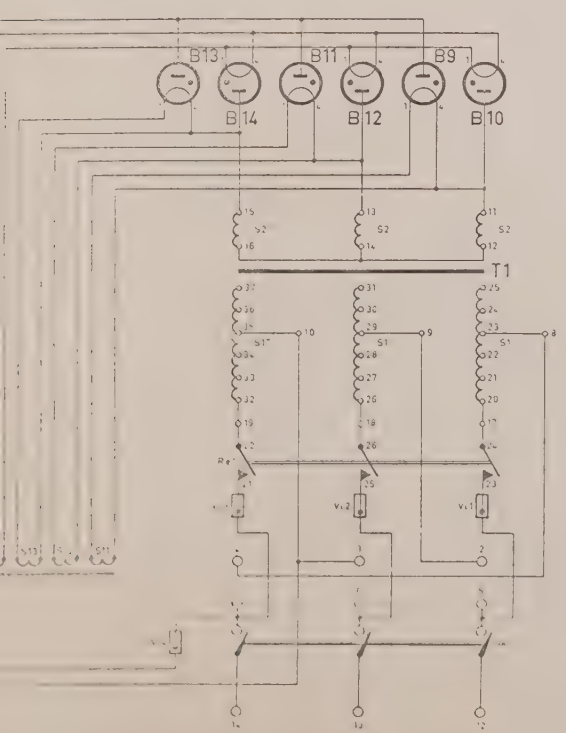
C 342 97

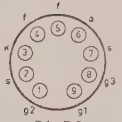
V3 622 51

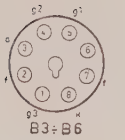
Fig.3

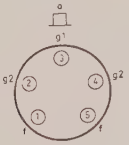

A
B
C
D
E
F
B1
B2
B3
B4
B15
B16
B17
T2
T3
M1
Gr1
V1
Sk1
Sk2
Sk3
Sk4
Re1
Re2
Re3
575mV
555mV
44mV
25V

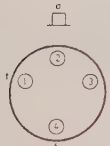




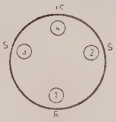

B1-B2

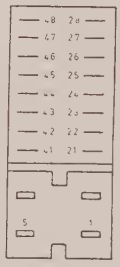

B3÷B6


B7-B8

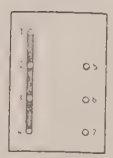

B9÷B14

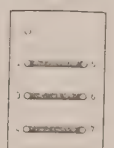
B15-B16


B17

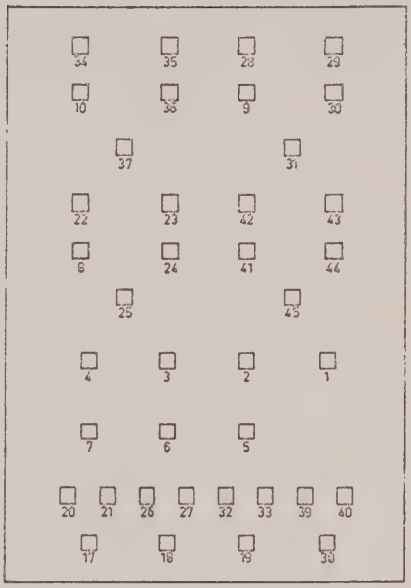

Re1

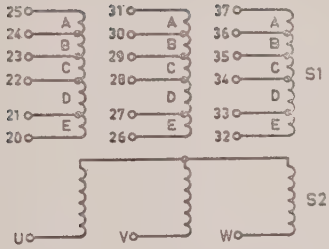
Re2





T1





S1					S2	
A	B	C	D	E		
9	19	19	18	9	1976	W
10	20	20	190	10	2080	V onb.
2.0					0.6	Ø

C 34 484

T1 . 831.01.

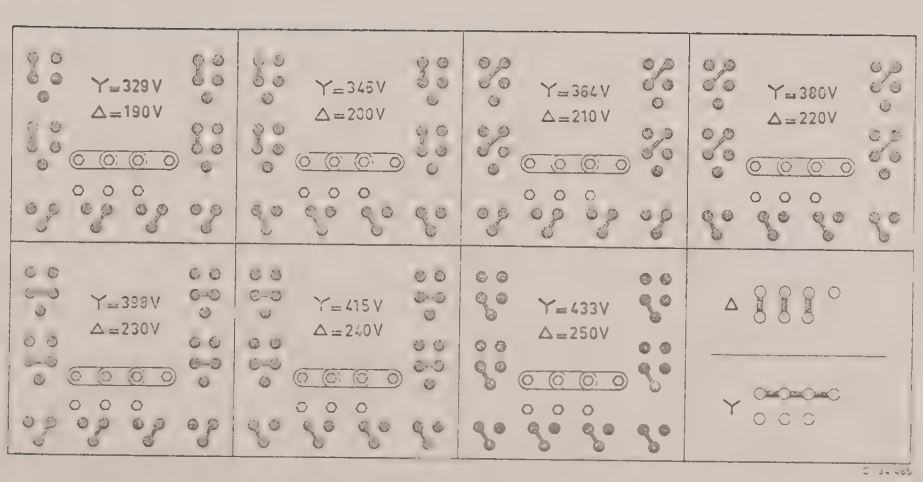


Fig.4

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INFORMATION

17.8.1961	EL 6472/00	Eb 162

In de 2-KVA-versterker EL 6472/00 is tussen de roosters van B7, B8 en aarde een condensator van 56 pF aangebracht.
Codenummer 905/56E

A capacitor of 56 pF has been provided in the 2 KVA amplifier EL 6427/00 between the grids of B7, B8 and earth.
Code number 905/56E

Im 2-KVA-Verstärker EL 6472/00 ist zwischen den Gittern von B7, B8 und Erde ein Kondensator von 56 pF angebracht.
Codenummer 905/56E

Dans l'amplificateur 2 KVA EL 6472/00 un condensateur de 56 pF a été prevu entre les grilles de B7, B8 et la terre.
Numéro de code 905/56E

En el amplificador de 2 KVA EL 6427/00 se ha previsto un condensador de 56 pF entre las rejillas de B7, B8 y tierra.
Numero de código 905/56E

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INFORMATION

20-9-1961	EL6471/00, EL6472/00, EL6473/ 12/15/16 119 435, 119 615	En 168

In the newest production series of the abovementioned kVA amplifiers, the Philips meter P 812 67 has been replaced by the Gossen-meter V3 725 22. The dimensions of the latter meter are smaller. As a result, the meters are difficult to mutually exchange and therefore both items are supplied under different code numbers. In event of order, we would request you to mention the correct code number :

Dimensions	P 812 67	: 90 x 90 mm
	V3 725 22	: 74 x 78 mm

Since the text plate V² 341 92.0 (pos. 5, fig. 2) of the 1 kVA-amplifier EL 6471 is never ordered, we do not itend stocking same in the future.

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Elx

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INFORMATION

17 8-'62	EL 6472/00-/15-/52	Eb 197

The following modifications have been introduced in the 2 kV amplifier EL 6472/00/15/52.

Electrical parts list

T3	input transformer		changed in				V3 622 51
RE1			" "				SZB 1000/003/c/b
RE2+RE3			" "				NF 164 48
SK5			added				OD 903 53
SK7			"				08 700 22
R59	changed in	2x 901/22k) 2x 901/22K) 930/A1CK	per	22 kΩ	2 W	carbon	5 %
R60-61				10 kΩ	10 W	carbon	5 %

Figures

Fig. 1 Circuit Diagram of the supply unit
Fig. 2 Transformer T3

Description of the modifications

When the bimetal relay B17 closes the energising circuit of RE2 is also closed. An interconnection should be made between the connection points 25-26 and 27-28 when no safety unit EL 6870 is used.

The following happens when RE2 is de energised :

a. The heating circuit of B17 is interrupted by contact 21-22.

b. RE2 remains energised by the take over contact 25-26.

c. The contacts 31-32 are closed. These contacts are used when several amplifiers are connected in parallel

d. The contact 28-29 close. The H.T. voltage may now be switched on; when SK5 has already been switched on, the high tension will be automatically switched on.

Eb.

Uitgave Philips N.V. PHILIPS' GLOEILAMPENFABRIEKEN, Eindhoven

The following happens when SK5 is switched on :

a. The electromagnetic switch SK7 is energised when the points 27-28 are short circuited.
The connection terminals have to be interconnected when they are not used.

b. Three "make" contacts of SK7 for the H.T. transformer T1 are closed.

c. The make contact 2-3 closes the circuit for the screen grid voltages of the output valves.

d. Make contact 4-5 energises the relay RE1.

e. The relay RE1 removes the short circuit at the input of the amplifier by means of the contact 42-44, while the make contact 43-42 connects the signal source to T3.

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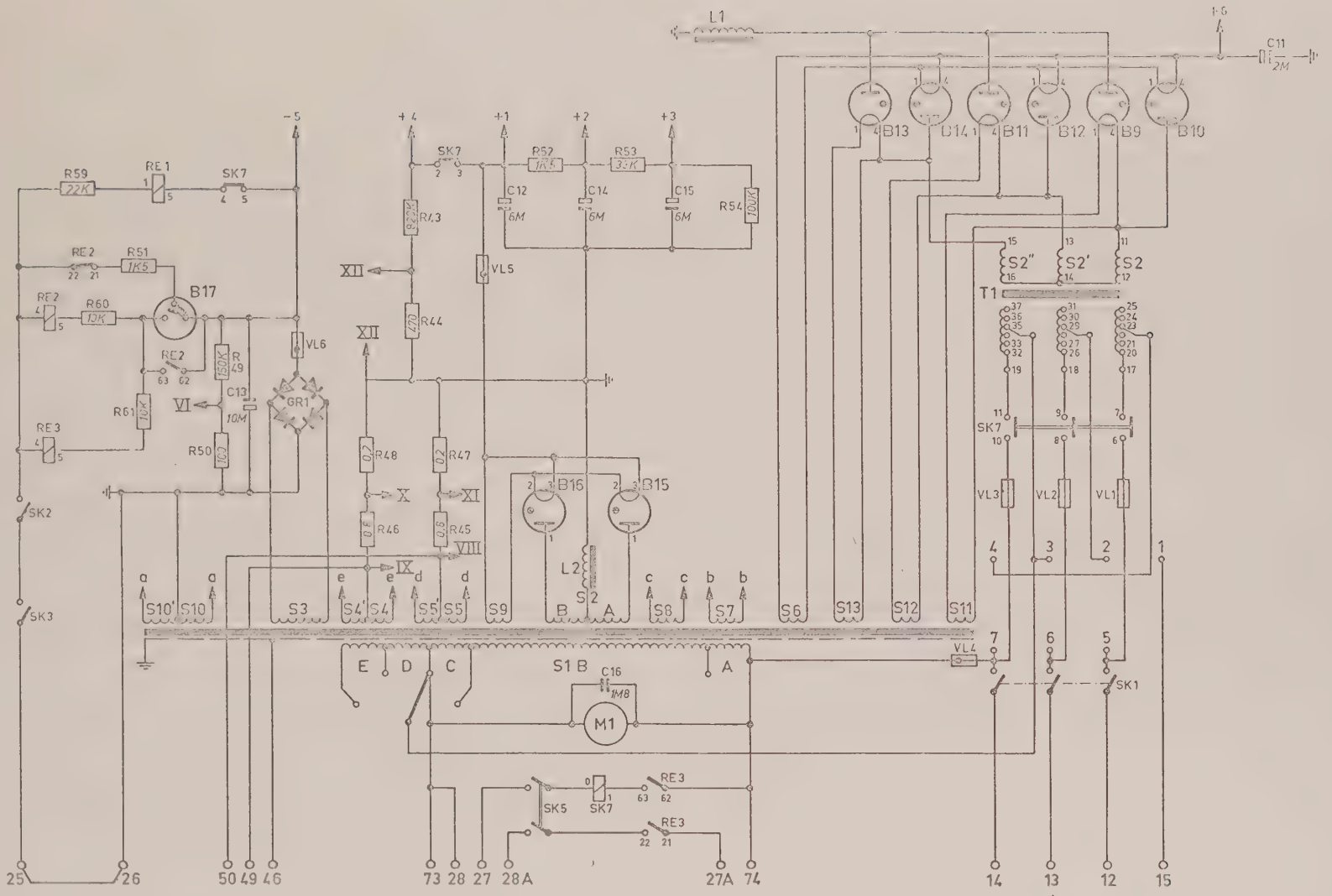
L1
C11 2M
B13
B14
B11
B12
B9
B10
S2"
S2'
S2
T1
SK7
VL3
VL2
VL1
VL4
SK1
R59 22K
RE1
SK7
RE2
R51 1K5
B17
RE2
R60 10K
RE2
R49 150K
C13 10M
R61 10K
RE3
R50 63
VL6
GR1
VI
XII
R43 82K
C12 6M
C14 6M
C15 6M
R54 100K
SK7
R52 1K5
R53 33K
VL5
R44 470
R48 0,2
R47 0,2
R46 0,6
R45 0,6
X
XI
VIII
IX
B16
B15
L2
S2
SK2
SK3
S10'
S10
S3
S4'
S4
S5'
S5
S9
B
A
S8
S7
S6
S13
S12
S11
S1 B
C16 1M8
M1
E
D
C
A
SK5
SK7
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28A
27A
74
14
13
12
15
C 356 04

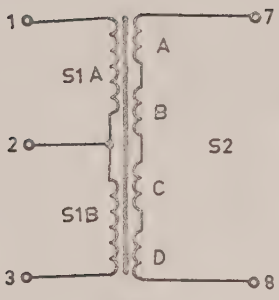
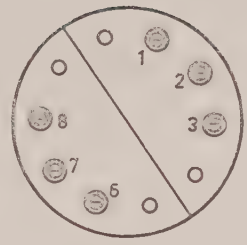


Fig.2



C342 97

PHILIPS *Service*

INFORMATION

3-2-1964	EL 6471, EL 6472, EL 6473	Eb 235

When replacing the output transformers of the 1, 2 and 10 kVA amplifiers we request you to check the negative feedback : Chapter "Checking the negative feedback" in the selevent Service Notes.

Reason : In view of possible phase errors.

- - - - -

Bij vervanging van de uitgangstransformatoren van de 1, 2 en 10 kVA-versterkers verzoeken wij U te tegenkoppeling te controleren : Hoofdstuk Controle tegenkoppeling in de desbetreffende documentatie.

Reden : De polariteit van de tegenkoppelwikkeling is niet bepaald.

- - - - -

Nous vous prions de bien vouloir vérifier la contre-réaction lorsque vous échangez les transformateurs des amplificateurs de 1, 2 et de 10 kVA : Chapitre "Contrôle de la contre-réaction" dans la documentation y relative.

Raison : La phase de l'enroulement de contre-réaction n'est pas déterminée.

- - - - -

Beim Ersatz der Ausgangstransformatoren der 1-, 2- und 10-kVA-Verstärker bitten wir Sie die Rückkopplung zu überprüfen : Kapitel "Kontrolle der Rückkopplung in der entsprechenden Kundendienstanleitung.

Grund : Die Phase der Rückkopplungswicklung ist nicht angegeben worden.

- - - - -

Al sustituir los transformadores de salida de los amplificadores de 1, 2 y 10 kVAle rogamos compruebe la realimentación : Cápitulo "Comprobación de realimentación" en la Documentación de servicio correspondiente.

Razón : La polaridad del devanado de realimentación no está indicada.

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